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RESEARCH ARTICLE

SUGARCANE LEAVES (*Saccharum officinarum*) ENSILIZED ALONE AND IN COMBINATION WITH LEGUMES, AS FOOD FOR FATTENING BOVINE CATTLE

Edgar Enrique Sosa Rubio[1], Gilbert José Herrera Cool[1], Carmen Zavaleta Cordova[1] and Rosendo Alcaraz Romero[2]

1. Campo Experimental Chetumal, km 25 Carretera Chetumal - Cancún s/n. Xul-ha, Quintana Roo,
2. Campo Experimental Mococha. INIFAP-CIRSE.

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Abstract

The objective of the study was to evaluate fresh and ensiled sugar cane leaves alone and combined with forage legumes on the consumption and weight gains of fattening bulls in the dry season. The study wascarried out in the Chetumal Experimental Field of INIFAP in Quintana Roo, which presents 27° C of temperature averageand 1200 mm of rainfall annual average. Swiss Zebu breed Steers of 250 kg ± 5 of average weight were used. All steers were dewormed and vitaminized, prior to their random distribution in three treatments. Food treatments were T1: fresh cane ends + molasses + urea + legume, T2: cane leaves silage + molasses + urea, and T3: only grazing. The test was carried out 210 days with 15 days of adaptation to handling and forage. Weighing were carried out every month. ANOVAand Tukey test were carried outto detect differences between means. The variables measured were daily weight gain and voluntary consumption. Results indicated differences in weight gains ($P \leq 0.05$) of 250, 214, and 190 g/animal per day for T1, T2, and T3 respectively. The average intake of dry matter (DM) was 5.23, 5.40 and 4.37 kg/day. In conclusion, using cane leavescan allow modest weight gains and could be an alternative food in the dry season.

Introduction:-

Sugarcane (*Saccharum officinarum*) is a crop produced in more than 100 countries worldwide. Biomass production of this species exceeds that of any other forage, making it a good animal feed strategy for sustainable agricultural development in many countries(Aranda Ibáñez et al., 2010; Reyes-Gutiérrezet al., 2020).The chemical composition of sugarcane top is 39.9% of dry matter, 7.42% of ash, 42.30% of crude fiber, 7.4% of crude protein and 2.90% of crude fat (Yanti, et al., 2021). This plant, tolerates drought very well (Misra et al., 2022), with a high nutritional value when mature, allowing easier management than any other grass and providing digestible energy during dry season (Beck et al., 2020). In the State of Quintana Roo, Mexico, the average production of this crop is 140 t $ha^{-1}$of stem with leaves (Arreola-Enríquez et al., 2019). The soluble fraction as animal feed is focused on ruminants due to its high fiber content (Kumar et al., 2021; Perlo et al., 2020),since, it offers the possibility of complementing the lack of pasture and forage in the dry season.One of the limitations to use sugarcane asanimal feeding is itslow protein content (Yanti, et al., 2021). However, to increase the quantity and quality of protein, the use of legumes as *Leucaena leucocephala* and *Gliricidia sepium* have shown be able to generate an animal feeding with good energy-

Corresponding Author:- Edgar Enrique Sosa Rubio
Address:- Campo Experimental Chetumal, km 25 carretera Chetumal - Cancún s/n. Xul-ha, Quintana Roo.

protein balance (Suwignyo et al., 2022; Flores-Cocas et al., 2021), allowing maintenance of growth, lactation and reproduction of the dual-purpose animal.In the state of Quintana Roo, forage production is markedly seasonal (Uu-Espens et al., 2022; Dibala, 2019). Thus, in summer there are abundant growth of good quality forage, which is underutilized. On the other hand, in dry season there are shortage (Ramos-Trejo et al., 2020), which causes weight loss in animals up to 70% andincrease in production costs (Villanueva-Partida et al., 2019; Ramírez-Avilés et al., 2019). Due to the high cost of feed animal supplement, it is necessary to look for sources cheaper, available and that can be used in the exploitation of livestock during dry season. Due to above mentioned the aim of this study was to evaluate the use of fresh and ensiled sugar cane tips alone and combined with forage legumes on the consumption and weight gains of fattening bulls in the dry season.

Materials and Methods:-

Area or study

The present study was carried out in Chetumal Experimental Field of the National Institute of Forestry, Agriculture and Livestock Research (INIFAP by Spanish acronyms) in Quintana Roo, located at 21°30' north latitude and 89°29' west longitude, at 10 meters above sea level (masl), with temperature average of 27.6°C and an annual rainfall average of 1200 mm.

Palability test

To select the legume with the best consumption in feeding experiment, a palatility test was carried out at the beginning. This test consisted in selecting randomly five steers and then fed them with cane silage for five days. On the sixth day, five feeders were placed with five forage species: Leucaena (*Leucaena leucocephala*), pixoy (*Guazuma ulmifolia*), mucuna (*Mucuna pruriens*), clitoria (*Clitoria ternatea*), and centrosema (*Centrosema pubescens*). All species were mixed with cane, one feeder contained cane tips and another one with complete cane.

Speed consumption and preference index

For twenty minutes, data on ingestive behavior were taken. Data evaluated were total number of bites per animal for each silage and silage consumption calculated between the weight offered and the weight rejected. With this information, the speed of consumption (g/min) was calculated, expressed as the quantity consumed of what was offered per unit of time and the biting speed (bites/min). The preference index was also determined, calculated as the fraction of the total number of bites per 5 min of each silage.Preference values range between 0 and 1, values less than 0.5 represent low preference.

Preparation of steers feed

For the feeding test, the process began with the green cutting of the cane tips, which were subsequently ground in a forage grinder. These were ensiled in micro-silos, to increase the nutritional value of the silage.Furthermore, molasses 500 (ml/kg) and urea (3%) per feeding mix were added. In order to improve the silo quality and accord to the palability test, the species pixoy (*Guazuma ulmifolia*) was added.

Evaluation of experiment

Twenty-four steers of Holstein-Cebu and Swiss-Cebu crosses were used. The initial average weight was 230 kg, distributed in a completely random design into three groups: 1) Fed with fresh cane tips + molasses + urea + legume, 2) fed with cane tips silage + molasses + urea, and 3) only grazing (traditional management of farmers). The animals were vitaminized, dewormed and identified with earrings. The experiment was executedfrom February to June. The steershad a period of diet adaptation of 15 days in three pens withfree water and mineral salts. The weigh wasmeasured every 28 days individually. Analysis of variance was carried out using the Stat Graphics Centurion Software®. Additionally, consumption and rejection of the diet were taken to determine food conversion.

Results and Discussion:-

Palatability test

The most preferred silage ($P \leq 0.05$) and consumption presented by the steers was cane tips associated with pixoy (*Guazuma ulmifolia*) (Table 1). Differences in preference between the mixtures evaluated could be attributed to the presence of secondary compounds (Moechiutti et al., 1995) and to the palatability of the species (Burns et al., 2001). Thus, the presence of these compounds adversely affected the consumption of the ensiled mixtures.

Table 1:- Ingestive behavior of steers using cane leaves and legumes.

Forage species used	BNA	VB(bite/min)	QC(g)	VC(g/min)	PI
L. leucocephala + C	640±4[b]	32±1[b]	0.20±2[d]	6.4±2[d]	0.6
M. pruriens + C	580±3[d]	29±1[cd]	0.23±d	6.6±3[d]	0.4
C. ternatea + C	600±3[bc]	30±2[c]	0.32±2[b]	9.6±3[b]	0.5
C. pubescens + C	580±5[cd]	29±1[c]	0.29±3[c]	8.4±2[c]	0.4
G. ulmifolia +C	760±6[a]	38±3[a]	0.62±1[a]	23.5±3[a]	0.7
*Cane leaves alone	560.± 2[d]	28±[1cd]	0.20±3[d]	5.6±3[e]	0.5
*Cane complete	600 ± 2[d]	30±2[c]	0.20±4[d]	6.0±2[c]	0.5

Different literals in a column show significant differences (P≤0.05). * feeding used as control. C: Cane leavesBNA: bites number average, VB: velocity of bite, QC: quantity of consume, VC: velocity of consume, PI: preference index.

The highest number of steer bites was obtained in feed mix of *G. ulmifolia* with cane leaves with 760±6 BNAas can be seen in Table 1.On the other hand, the lowest value corresponded to *M. pruriens*with cane leaves that can be observed in the same table with 580±5 BNA. Biting speed results followed a pattern with higher values (P≤0.05) for *Guazuma ulmifolia*with 38 bites/min.The highest values of QC and PI can be seen in the same feeding mix*G. ulmifolia* with cane leaves) 0.62±1 g and 0.7 respectively. Compared with the rest of the species, steers showed a marked preference for Guazuma ulmifoliamixed with cane tips. In general, the low preference for forage species in ruminants may be associated with the morphological development and plant structure (Portugal et al., 2022) as well as secondary compounds (Ortiz-Dominguez et al., 2022). However, the morphological development and the structure of the plant were not determinant factors for the preference, since the part of the species that was offered was only the leaves in growth stage. The differences in preference between the evaluated species could be attributed to the presence of secondary compounds and the taste of the plants. In this way, the presence of these compounds adversely affected the consumption of plants associated with cane tips, even when they had high preference consumption levels and good digestibility.

Feeding test

Weight gains of animal obtained were 250, 214 and 190 g/animal per day for the treatments T1 fresh cane leaves + legume, T2 ensiled cane alone and T3 control group conventional management of the producer (only grazing). The weight gains observed are similar to those observed byTorres-Moreira (2009), who do not detected differences between three feed supplying of cane obtained gains of 180, 169 y 140 g/animal/day. The highest average obtained in the cane + legume treatment coincided with the results of Fairhurst and Pate (1987) who mentioned that animalsfeed with a mixture of cane with*Gliricidia sepium*, obtained gains of 700 g/animal/day in a period of 134 days.

Table 2:- Weight gain of steers in the dry season fed with fresh cane leaves alone and associated with legumes.

Treatments	Kg per animal average	WG
T1	50±2	250±2[a]
T2	40±1	214±3[b]
T3	37±1	190±3[b]

Different literals in a column show significant differences (P≤0.05). T1: Cane fresh leaves+ legume, T2: Silaged cane leaves aloneand T3: Conventional manage, WG: Weight gain.

As can be observed in Table 2, the results obtained were lower than reported by Avellaneda (2006), who mention that weight gain obtained in his research was up to 500 g/animal/day. The low weight gains obtained in our research could be attributed to the legume used and/or the low consumption of the diet by the animal (Martín, 2005). It has been indicated that cane consumption can be increased by supplementing non-protein nitrogen (NNP) and natural protein (Aranda et al., 2018).The average consumption of silage for T1 and T2 was 15 and 14 kg/day respectively, with not significative differences (P≥0.05) between treatments. The consumption of dry matter (DM) was 5.23 and 4.37 kg/day. In treatments T1 and T2, a tendency to reduce voluntary consumption was observed as the test lasted, which could explain the poor gains recorded. Moreover, no significant difference (P≥0.05) was detected in the consumption of dry matter from forage, consumption was lower than that reported for cane silage used in dairy cows (6.40 kg/dry basis), this difference can be explained by the type of experimental animals, since milk-producing cattle have a better acceptance of foods with different tastes (Burbano et al., 2022). On the other hand, Wilkins et al.

(1971) have observed that the voluntary consumption of silage is positively correlated with the content of dry matter, nitrogen and lactic acid.As well as, negatively correlated with the concentration of acetic acid and ammonium. However, these values obtained in this test were higher than those reported in beef cattle fed with cane silage and with less concentrate. Fairhurst and Pate (1987) working with stabled heifers with gains of 700 g/animal/day in a period of 134 days, an increase that they attributed to the adjustment of the balance of nutrients in the diet, efficiently improving metabolism and growth in the animal. It is important to mention that the information available, in relation to the productive behavior of animals fed with forage based on sugarcane, has shown that there are great variations, standing out from weight loss to gains, showing a variability of response depending on the type of supplement feed used. Likewise, it is necessary to mention that the animals grazed relatively low-quality forage species in paddocks. This could influence the low response between treatments, thus corroborating those indicated by Aranda et al. (2000) who indicate that the weight gain per animal and per surface unit in cattle supplemented with sugar cane and grazing is a function of the growth potential of the animals individually.

Conclusions:-

The best treatment obtained was cane leaves associated with *G. ulmifolia*. It is feasible to feed fattening bulls with sugar cane silage alone or in combination with legumes as forage, thus avoiding losing weight in the animals in the dry season but obtaining modest weight gains. The use of legumes associated with ensiled sugarcane does not modify the characteristics of the final silage, allowing good forage intake and modest weight gains.

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